

# Emotional Contagion with Artificial Others. Effects of Culture, Physical Appearance, and Nonverbal Behavior on the Perception of Positive/Negative Affect in Avatars

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**Abstract.** In the present study, we investigated whether cultural stereotypes activated through the physical appearance of avatars would influence the perception of positive and negative affect in in- and out-group members. In a first study, forty-three German and forty Arab participants saw short video clips of a German and an Arab avatar displaying ambiguous nonverbal behavior. In spite of cultural stereotypes, both Arab and German participants attributed more positive emotions to the Arab avatar than to the German avatar. To further investigate these counterintuitive results, we conducted a follow-up study, in which fifty-two German and fifty-two Arab participants rated the valence of both avatars. Both German and Arab participants rated the Arab avatar significantly more positively than the German avatar. Taken together, the results of both studies show that the valence of avatars has the potential to override cultural stereotypes and influence the perception of positive and negative affect.

**Keywords:** Culture, Stereotypes, Avatars, Nonverbal Behavior.

## 1 Introduction

Contrary to real-life interactions, online communities allow their members to interact with each other using virtual avatars, giving members control over their physical appearance and helping them to reduce the influence of stereotypes in interactions. In off-line interactions, stereotypes activated by the physical appearance of others can have a strong—and often negative—influence on our perception of nonverbal behavior. For instance, a large body of research has focused on the perception of the nonverbal behavior of African Americans. Because African Americans are stereotypically perceived to be aggressive [1], ambiguous nonverbal behaviors by African Americans are also interpreted as aggressive or negative. In line with this argument, several studies have shown that ambiguous nonverbal behaviors by African Americans are perceived more negatively [2]. For instance, Hugenberg et al. [3] could show that White participants were faster at detecting anger in Black faces as compared to White Faces. Also, Duncan [4] could show that the same nonverbal act was rated to be more violent

by White observers if perpetrated by a Black person. Another well-researched cultural group with regard to cultural stereotypes are Arabs/Muslims [5]. For instance, Unkelbach et al. [6] could show a significant bias in participants to shoot men wearing Muslim headgear as opposed to neutral looking men. Taken together, real-life interactions are often influenced by the cultural background and physical appearance of the persons interacting.

On the other hand, online communities, such as Second Life, allow its members to represent themselves with avatars that may or may not correspond to their own culture, giving members control over their physical appearance and helping them to reduce the influence of stereotypes in interactions. One central question is, however, whether results on the influence of cultural stereotypes on the perception of nonverbal behavior also apply to virtual online interactions. In a first study, with regard to general nonverbal social norms, Yee et al. [7] could show that interpersonal distance and eye gaze transfer were comparable between online virtual environments and real-life interactions. Therefore, online virtual environments, with their almost unlimited degrees of freedom, pose a huge potential for research [8]. Consequently, several studies have investigated the effect of avatars on the persons controlling them: For instance, with regard to the effect of the physical appearance of avatars on their players, Yee et al. [9] could show that an avatars height and physical attractiveness affected a player's performance. In another study, Pena et al. [10] found that avatars could prime negative attitudes in their players in group discussions. However, despite their widespread use in psychological research [11], only few studies so far have investigated whether cultural stereotypes also influence the perceptions of avatars. In a first study, Vang et al. [12] investigated the influence of an avatars' culture on its evaluation in a cooperative game. However, contrary to their hypotheses, Vang et al. [12] did not find evidence for the effect of cultural stereotypes, with White participants in their study evaluating Black avatars more positively than White avatars.

It remains, therefore, an open question if the strong effect of cultural stereotypes on the perception of behavior can also be found for avatars in virtual encounters.

In the present study, we investigated whether cultural stereotypes activated through the physical appearance of avatars would influence the perception of positive and negative affect in in- and out-group members. To test this hypothesis, we presented students from Germany and the United Arab Emirates with an avatar of their own culture and an avatar of a foreign culture. These two cultures were chosen because of the high prevalence of negative cultural stereotypes towards Arabs/Muslims [5,6].

Participants saw 40 short video clips of members from both cultures (20 video clips with a European avatar and 20 video clips with an Arab avatar) displaying ambiguous nonverbal behavior. Participants decided for each clip whether the displayed emotion was either anger or happiness. Based on previous studies on the influence of stereotypes on the perception of facial emotions in White and Black faces [3], we hypothesized that positive emotions (happiness) would be attributed faster to in-group members, and that negative emotions (anger) would be attributed faster to out-group members. In addition, we hypothesized that more positive emotions would be attributed to the avatar of the own culture and more negative emotions to the avatar of the foreign culture.

In sum, the goal of the present study was to investigate whether cultural stereotypes activated through the physical appearance of avatars would influence the attribution of anger and happiness to in- and out-group members.

## 2 Experiment 1

### 2.1 Methods

**Participants.** Overall, 43 German students from the University of Cologne (21 male, 22 female,  $M_{\text{age}} = 22.37$ ,  $SD_{\text{age}} = 2.98$ ) and 40 Arab students from the American University of Sharjah (20 male, 20 female,  $M_{\text{age}} = 19.70$ ,  $SD_{\text{age}} = 1.54$ ) participated in the study.

**Stimulus Materials.** In the present study, motion-capture technology was used to record the nonverbal behavior. This approach has the advantage that the same recorded movements can be displayed by different virtual avatars. We used one Arab and one European avatar (see Figure 1) from a database of commercially available avatars [13].



**Fig. 1.** Arab (left) and European avatar (right) used in Experiment 1

In order not to bias participants towards positive or negative emotions, the avatars showed a neutral facial expression. Five actors were recorded individually performing short emotional scenes displaying either anger or happiness. Out of these recordings, 44 short scenes were selected. In a prestudy, 30 participants (12 male, 18 female;  $M_{\text{age}} = 24.90$ ,  $SD_{\text{age}} = 4.57$ ) watched the emotional scenes with a neutral avatar and decided for each scene whether the displayed emotion was anger or happiness. Ratings of happiness were coded with a 0; ratings of anger were coded with a 1. For each scene, an average score was calculated ranging from 0 (all participants decided the scene was happiness) to 100 (all participants decided the scene was anger). Because the goal of the present study was to investigate whether cultural stereotypes would influence emotion perception, we selected emotional scenes that were ambiguous and could be

interpreted as either anger or happiness. Based on the results of the prestudy, 40 emotional scenes were selected. The average score for the 40 scenes was 55.10 %, indicating that participants were equally likely to attribute anger or happiness to the scenes, with a slight bias to perceive the scenes as anger. In the main experiment, cultural stereotypes were activated through the appearance of the avatar—Arab or European. Thus, each emotion was either displayed by the Arab or European avatar. In the final stimulus set, 20 emotions were displayed by the Arab avatar, and 20 emotions were displayed by the European avatar. Two different stimulus lists were created to balance the emotions displayed by each avatar.

**Procedure.** At the beginning of the experiment, participants were asked to sit down in front of a computer and told that they would now see avatars display different emotions. Additionally, they were told that their task would be to decide for each emotion whether it was anger or happiness. Also, participants were informed that after each choice they should indicate how certain they were in their decision on a scale ranging from 1 (*very uncertain*) to 7 (*very certain*). After participants had completed four practice trials, they proceeded to the forty experimental trials. At the end of the study, participants were compensated for their participation and debriefed.

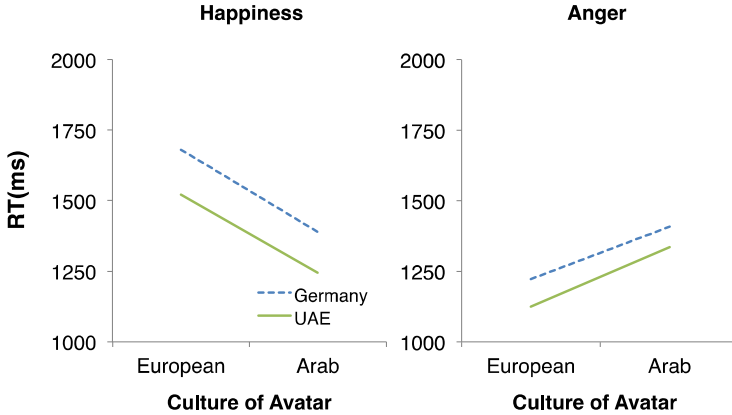
## 2.2 Results

**Number of Anger Attributions.** At first, we analyzed if participants' culture would influence the number of negative emotions attributed to the Arab and European avatar. It is important to note that because the choice was complementary, analyzing the amount of anger or happiness attributed to the Arab and European avatar leads to the same results. We therefore only present the analysis for the amount of anger attributed to both avatars. To analyze the influence of the culture of the participants and the culture of the avatar on the attribution of anger, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) mixed ANOVA. There was a significant main effect of culture of avatar,  $F(1, 81) = 259.67, p < .001, \eta^2_p = .762$ . All other effects were not significant,  $F < 3.45$ . German participants attributed significantly more anger to the European avatar ( $M = 15.79, SD = 2.59$ ) compared to the Arab Avatar ( $M = 10.02, SD = 2.36$ ),  $t(42) = 12.71, p = .001, d = 1.94$ . Arab participants also attributed significantly more anger to the European avatar ( $M = 15.23, SD = 2.87$ ) compared to the Arab avatar ( $M = 10.65, SD = 3.87$ ),  $t(39) = 10.11, p = .001, d = 1.61$ .

### Reaction Times

*Happiness.* To analyze the speed with which participants attributed happiness to the two avatars, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) mixed ANOVA with reaction times as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 77) = 13.17, p = .001, \eta^2_p = .146$ . All other effects were not significant,  $F < 1.80$ . German participants were significantly faster at attributing happiness to the Arab avatar ( $M = 1389, SD =$

401) compared to the European avatar ( $M = 1681$ ,  $SD = 731$ ),  $t(41) = 2.91$ ,  $p = .006$ ,  $d = 0.45$ . Arab participants were also significantly faster at attributing happiness to the Arab avatar ( $M = 1244$ ,  $SD = 382$ ) compared to the European ( $M = 1521$ ,  $SD = 817$ ) avatar,  $t(36) = 2.27$ ,  $p = .030$ ,  $d = 0.37$  (see Figure 2).



**Fig. 2.** Mean reaction times for German and Arab participants for attributing happiness and anger to the European and Arab avatar

*Anger.* To analyze the speed with which participants attributed anger to the two avatars, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) mixed ANOVA with reaction times as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 81) = 20.25$ ,  $p < .001$ ,  $\eta^2_p = .200$ . All other effects were not significant,  $F < 1$ . German participants were significantly faster at attributing anger to the European avatar ( $M = 1209$ ,  $SD = 409$ ) compared to the Arab avatar ( $M = 1398$ ,  $SD = 451$ ),  $t(42) = 3.28$ ,  $p = .002$ ,  $d = 0.50$ . Arab participants were also significantly faster at attributing anger to the European avatar ( $M = 1126$ ,  $SD = 328$ ) compared to the Arab avatar ( $M = 1328$ ,  $SD = 421$ ),  $t(39) = 3.09$ ,  $p = .004$ ,  $d = 0.49$ .

### Certainty

*Happiness.* To analyze the certainty with which participants attributed happiness to the two avatars, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) mixed ANOVA with certainty as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 78) = 18.97$ ,  $p = .001$ ,  $\eta^2_p = .196$ . All other effects were not significant,  $F < 1$ . German participants were significantly more certain at attributing happiness to the Arab avatar ( $M = 4.56$ ,  $SD = 0.82$ ) compared to the European avatar ( $M = 4.13$ ,  $SD = 1.04$ ),  $t(41) = 3.07$ ,  $p = .004$ ,  $d = 0.47$ . Arab participants were also significantly more certain at attributing happiness to the Arab avatar ( $M = 4.68$ ,  $SD = 1.01$ ) compared to the European avatar ( $M = 4.37$ ,  $SD = 0.99$ ),  $t(37) = 3.44$ ,  $p = .001$ ,  $d = 0.54$ .

*Anger.* To analyze the certainty with which participants attributed anger to the two avatars, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) mixed ANOVA with certainty as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 81) = 27.99, p < .001, \eta^2_p = .257$ . All other effects were not significant,  $F < 2.04$ . German participants were significantly more certain at attributing anger to the European avatar ( $M = 5.06, SD = 0.78$ ) compared to the Arab avatar ( $M = 4.59, SD = 0.79$ ),  $t(42) = 4.64, p < .001, d = 0.70$ . Arab participants were also significantly more certain at attributing anger to the European avatar ( $M = 5.16, SD = 0.96$ ) compared to the Arab avatar ( $M = 4.89, SD = 1.00$ ),  $t(39) = 2.82, p = .007, d = 0.44$ .

### 2.3 Discussion

Contrary to our hypotheses, both Arab and German participants attributed more positive emotions to the Arab avatar than to the European avatar; additionally, both groups attributed more negative emotions to the German avatar than to the Arab avatar. Also, participants from both cultures were faster at attributing happiness to the Arab avatar and slower at attributing anger the Arab avatar. Even though the results of the Arab participants seem to support the effect of cultural stereotypes on the perception of nonverbal behavior, the results of the German participants hint at the fact that some factor other than cultural stereotypes might have influenced participants' perception.

Two explanations are possible: First, the two avatars were not representative of their respective cultures—European and Arab—and did therefore not activate cultural stereotypes. Especially the European avatar, to which more negative emotions were attributed, may not have been perceived to be European by the German participants. It is possible that the German participants perceived the European avatar to be an out-group member and therefore attributed more negative emotions to it.

Second, both avatars may have differed with regard to valence. Because more happiness was attributed to the Arab avatar, it is possible that the Arab avatar was generally perceived to be more positive by the participants, which might have biased participants to attribute more happiness and less anger to the avatar. Additionally, even though both avatars showed a generally neutral facial expression, it is still possible that participants perceived the Arab avatar to show a more positive facial expression, which might have also influenced the perception of the nonverbal behavior. In sum, based on the results of Experiment 1, it is possible that either the valence or the displayed emotion of the avatars may have overwritten the influence of cultural stereotypes.

To further explore these two possible explanations, we conducted Experiment 2, in which we presented a new group of participants with images of the two avatars in a neutral posture and asked them to rate the valence, displayed emotion, European typicality, and Arab typicality of the avatars.

## 3 Experiment 2

### 3.1 Methods

**Participants.** Overall, 52 German students (21 male, 31 female,  $M_{\text{age}} = 24.21$ ,  $SD_{\text{age}} = 3.94$ ) and 52 Arab students (21 male, 31 female,  $M_{\text{age}} = 19.63$ ,  $SD_{\text{age}} = 1.99$ ) participated in the study. Participants were recruited through email invitations sent via mailing lists of several universities in Germany and the United Arab Emirates.

**Stimulus Materials.** One image each of the German and the Arab avatar from Experiment 1 was used in this study. Both avatars had the exact same neutral posture.

**Procedure.** In the study, participants were randomly presented with the image of either the European or Arab avatar. Participants then rated the following attributes: valence, ranging from 1 (*very negative*) to 5 (*very positive*); displayed emotion, ranging from 1 (*very angry*) to 5 (*very happy*); European typicality, ranging from 1 (*very untypical*) to 5 (*very typical*); and Arab typicality, ranging from 1 (*very untypical*) to 5 (*very typical*).

### 3.2 Results

**Valence.** To analyze how positive participants perceived the two avatars, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) ANOVA with valence as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 100) = 19.71$ ,  $p < .001$ ,  $\eta^2_p = .165$ . All other effects were not significant,  $F < 2$ . German participants rated the Arab avatar ( $M = 2.97$ ,  $SD = 0.63$ ) to be significantly more positive than the European avatar ( $M = 2.26$ ,  $SD = 0.62$ ),  $t(50) = 4.05$ ,  $p < .001$ ,  $d = 1.14$ . Arab participants were also rated the Arab avatar ( $M = 2.83$ ,  $SD = 0.71$ ) to be significantly more positive than the European avatar ( $M = 2.43$ ,  $SD = 0.51$ ),  $t(50) = 2.24$ ,  $p = .030$ ,  $d = 0.65$  (see Figure 3).

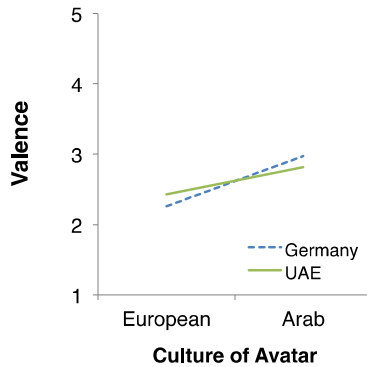


Fig. 3. Mean valence ratings for the European and Arab avatar

**Displayed Emotion.** To analyze what emotion participants thought the two avatars displayed, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) ANOVA with displayed emotion as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 100) = 70.47, p < .001, \eta_p^2 = .413$ . All other effects were not significant,  $F < 2.5$ . German participants rated the Arab avatar ( $M = 3.62, SD = 0.62$ ) to be significantly more happy than the European avatar ( $M = 2.61, SD = 0.58$ ),  $t(50) = 5.99, p < .001, d = 1.68$ . Arab participants were also rated the Arab avatar ( $M = 3.44, SD = 0.63$ ) to be significantly more happy than the European avatar ( $M = 2.39, SD = 0.66$ ),  $t(50) = 5.89, p < .001, d = 1.64$ .

**European Typicality.** To analyze to what degree participants perceived the two avatars to be European, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) ANOVA with European typicality as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 100) = 208.01, p < .001, \eta_p^2 = .675$ . All other effects were not significant,  $F < 1$ . German participants rated the European avatar ( $M = 3.65, SD = 0.78$ ) to be significantly more European than the Arab avatar ( $M = 1.38, SD = 0.56$ ),  $t(50) = 12.26, p < .001, d = 3.34$ . Arab participants were also rated the European avatar ( $M = 3.57, SD = 1.12$ ) to be significantly more European than the Arab avatar ( $M = 1.34, SD = 0.67$ ),  $t(50) = 8.87, p < .001, d = 2.41$ .

**Arab Typicality.** To analyze to what degree participants perceived the two avatars to be Arab, we performed a 2 (culture of observer: German vs. Arab)  $\times$  (culture of avatar: European vs. Arab) ANOVA with Arab typicality as the dependent variable. There was a significant main effect of culture of avatar,  $F(1, 100) = 113.83, p < .001, \eta_p^2 = .532$ . There was also a significant interaction effect between culture of avatar and culture of observer,  $F(1, 100) = 27.22, p < .001, \eta_p^2 = .214$ . All other effects were not significant,  $F < 1$ . German participants rated the Arab avatar ( $M = 4.38, SD = 0.73$ ) to be significantly more Arab than the European avatar ( $M = 1.48, SD = 0.67$ ),  $t(50) = 14.82, p < .001, d = 4.14$ . Arab participants were also rated the Arab avatar ( $M = 3.52, SD = 1.07$ ) to be significantly more Arab than the European avatar ( $M = 2.52, SD = 1.16$ ),  $t(50) = 3.23, p < .001, d = 0.90$ .

### 3.3 Discussion

Based on the counterintuitive results of Experiment 1, the goal of Experiment 2 was to explore potential factors that might have overwritten the influence of cultural stereotypes. With regard to cultural typicality, the results of Experiment 2 show that both avatars did match our selection criteria. The European avatar was perceived to be significantly more European than the Arab avatar. Also, the Arab avatar was perceived to be significantly more Arab than the European avatar. Thus, it is likely that the European avatar was perceived to be an in-group member by the European participants and an out-group member by the Arab participants.



With regard to valence, the results of Experiment 2 show that the Arab avatar was rated to be significantly more positive than the European avatar. Also, the displayed emotion of the Arab avatar was rated to be significantly more happy than the European avatar. Combining these findings, the results of Experiment 2 suggest that the generally higher valence of the Arab avatar could explain the results of Experiment 1. Therefore, the valence of an avatar may be a factor with the potential to overwrite cultural stereotypes.

## 4 General Discussion

The goal of the present study was to investigate whether cultural stereotypes induced by the physical appearance of avatars would influence the perception of two basic emotions: anger and happiness. Based on extensive findings from social psychology [3-5], we hypothesized that positive emotions (happiness) would be attributed faster to in-group members, and that negative emotions (anger) would be attributed faster to out-group members. In addition, we hypothesized that more positive emotions would be attributed to the avatar of the own culture and more negative emotions to the avatar of the foreign culture.

Contrary to our hypotheses and in spite of cultural stereotypes, both Arab and German participants attributed more positive emotions to the Arab avatar than to the German avatar; additionally, both groups attributed more negative emotions to the German avatar than to the Arab avatar. To further clarify this counterintuitive result, Experiment 2 revealed that the Arab avatar was of significantly higher valence than the European avatar. Taken together, the results of both studies show that the valence of avatars has the potential to override cultural stereotypes and influence the perception of positive and negative affect. Thus, nonverbal behavior of an avatar of high valence—even if he does belong to an out-group—can be perceived positively. In sum, avatars have the potential to help overcome cultural stereotypes and can be used in online communities to enable more unbiased interactions.

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